# Personal Project

## How does soil pH affect biodiversity?

I will try to find whether plant organisms prefer a low (acidic), neutral or high (alkali) pH in soils by using representative sampling to calculate the biodiversity & a soil pH kit to determine to soil pH.

### Hypothesis:

I predict that most species of plants would prefer a more neutral pH. Therefore I would expect a higher biodiversity of plants in neutral pH soils. This is a result of various factors where more extreme / harsh pH conditions may be unsuitable to the plants. For example, decomposition cannot take place in too acidic conditions as there would be a lack of detritivores/ decomposers as the cannot live in those conditions; this would result in the absense of mineral recycling & therefore a smaller plant population. However, in neutral conditions, more plants are more likely to be able to survive in those conditions, thus allowing for higher biodiversity.

### Variables:

Independent : soil pH

Dependent : number of different plant species / biodiversity

Control :
- light intensity
- time of the year / day
- gradient of slope
- canopy cover
- distance from human interference
- location; latitude, climatic variances

Example 2

## Method:

- I will choose various locations to measure the soil pH in accordance to the control variables in order to keep it a fair test. This would mean trying to keep all control variables as similar as possible.
- I will take a sample of soil from a suitable location & test its pH level using the soil pH kit & universal indicator.
- Then use the representative sampling method in conjunction with the Simpson's Index to calculate biodiversity.
- To use representative sampling, follow these steps:
  1. Make a 1m by 1m quadrat, forming an area of $1m^2$
  2. Count the number of species in the quadrat.
  3. Increase the size of the quadrat by 1m eg: 2m by 2m, to form an area of $4m^2$.
  4. Count the number of species in the quadrat
  5. If the number of species is the same, return to be previous, smaller quadrat, & count the number of individuals of each species. If the number of species is still different, increase the size of the quadrat by 1m on each side again, remembering to keep 1 corner the same at all times. eg: 3m by 3m, forming an area of $9m^2$.
  6. Repeat the process until you have the same amount of species in two quadrats so you can count the number of individuals of each species. Using the Simpson's Index, biodiversity (D) = $\frac{N(N-1)}{\Sigma n(n-1)}$, calculate the biodiversity of the representative sample for that area in conjunction to its soil pH.

  N.B. in Simpson's Index, N = total number of organisms, n = number of individuals of a species.

- Compare findings to try identify correlations between soil pH & biodiversity.

Results:

A table of results & equations to show the soil pH of a site in relation to its biodiversity using the Simpson's Index & representative sampling of the area.

| site number | pH level | species | n (number of individuals) | Simpson's Index (n-1) | n(n-1) |
|---|---|---|---|---|---|
| 1 | 4 | A | 35 | 34 | 1190 |
| | | B | 3 | 2 | 6 |
| | | C | 2 | 1 | 2 |

$N = 40$

$N(N-1) = 40 \times 39 = 1560$

$\Sigma n(n-1) = 1198$ (see table of results)

$\therefore$ biodiversity $= \frac{N(N-1)}{\Sigma n(n-1)} = \frac{1560}{1198} = 1.3$

A table of results & equations to show the soil pH of a site in relation to its biodiversity using the Simpson's Index & representative sampling of the area.

| site number | pH level | species | n (number of individuals) | Simpson's index (n-1) | n(n-1) |
|---|---|---|---|---|---|
| 2 | 4.5 | A | 2 | 1 | 2 |
| | | B | 23 | 22 | 506 |
| | | C | 6 | 5 | 30 |
| | | D | 9 | 8 | 72 |

$N = 40$

$N(N-1) = 40 \times 39 = 1560$

$\Sigma n(n-1) = 610$ (see table of results)

$\therefore$ biodiversity $= \frac{N(N-1)}{\Sigma n(n-1)} = \frac{1560}{610} = 2.6$

A table of results & equations to show the soil pH of a site in relation to its biodiversity using the Simpson's Index & representative sampling of the area.

| site number | pH level | species | n (number of individuals) | Simpson's Index (n-1) | Simpson's Index n(n-1) |
|---|---|---|---|---|---|
| 3 | 5 | A | 3 | 2 | 6 |
| | | B | 1 | 0 | 0 |
| | | C | 8 | 7 | 56 |
| | | D | 2 | 1 | 2 |
| | | E | 4 | 3 | 12 |
| | | F | 5 | 4 | 20 |
| | | G | 2 | 1 | 2 |
| | | H | 5 | 4 | 20 |
| | | I | 3 | 2 | 6 |
| | | J | 1 | 0 | 0 |
| | | K | 1 | 0 | 0 |
| | | L | 4 | 3 | 12 |

$N = 39$

$N(N-1) = 39 \times 38 = 1482$

$\Sigma n(n-1) = 136$ (see table of results)

$\therefore$ Biodiversity $= \frac{N(N-1)}{\Sigma n(n-1)} = \frac{1482}{136} = 10.9$

A table of results & equations to show the soil pH of a site in relation to its biodiversity using the Simpson's Index & representative sampling of the area.

| site number | pH level | species | n (number of individuals) | Simpson's Index | |
|---|---|---|---|---|---|
| | | | | (n-1) | n(n-1) |
| 4 | 5 | A | 2 | 1 | 2 |
| | | B | 3 | 2 | 6 |
| | | C | 3 | 2 | 6 |
| | | D | 7 | 6 | 42 |
| | | E | 2 | 1 | 2 |
| | | F | 1 | 0 | 0 |
| | | G | 3 | 2 | 6 |

$N = 21$

$N(N-1) = 21 \times 20 = 420$

$\Sigma n(n-1) = 64$ (see table of results)

$\therefore$ Biodiversity $= \frac{N(N-1)}{\Sigma n(n-1)} = \frac{420}{64} = 6.6$

Example 2

A table of results & equations to show the soil pH of a site in relation to its biodiversity using the Simpson's Index & representative sampling of the area.

| site number | pH level | species | n (number of individuals) | Simpson's Index (n-1) | Simpson's Index n(n-1) |
|---|---|---|---|---|---|
| 5 | 5.5 | A | 3 | 2 | 6 |
| | | B | 2 | 1 | 2 |
| | | C | 1 | 0 | 0 |
| | | D | 2 | 1 | 2 |
| | | E | 1 | 0 | 0 |
| | | F | 1 | 0 | 0 |
| | | G | 2 | 1 | 2 |
| | | H | 1 | 0 | 0 |
| | | I | 1 | 0 | 0 |

$N = 14$

$N(N-1) = 14 \times 13 = 182$

$\Sigma n(n-1) = 12$ (see table of results)

$\therefore$ Biodiversity $= \frac{N(N-1)}{\Sigma n(n-1)} = \frac{182}{12} = 15.2$

A table of results & equations to show the soil pH of a site in relation to its biodiversity using the Simpson's Index & representative sampling of the area.

| site number | pH level | species | n (number of individuals) | Simpson's Index (n-1) | n(n-1) |
|---|---|---|---|---|---|
| 6 | 7 | A | 6 | 5 | 30 |
| | | B | 3 | 2 | 6 |
| | | C | 4 | 3 | 12 |
| | | D | 2 | 1 | 2 |
| | | E | 6 | 5 | 30 |
| | | F | 3 | 2 | 6 |
| | | G | 1 | 0 | 0 |
| | | H | 1 | 0 | 0 |

$N = 26$

$N(N-1) = 26 \times 25 = 650$

$\Sigma n(n-1) = 86$ (see table of results)

$\therefore$ biodiversity $= \frac{N(N-1)}{\Sigma n(n-1)} = \frac{650}{86} = 7.6$

A table of results to show the pH levels of various site in conjunction with its biodiversity.

| site number | pH level | biodiversity |
|---|---|---|
| 1 | 4 | 1.3 |
| 2 | 4.5 | 2.6 |
| 3 | 5 | 10.9 |
| 4 | 5 | 6.6 |
| 5 | 5.5 | 15.2 |
| 6 | 7 | 7.6 |

Conclusion:

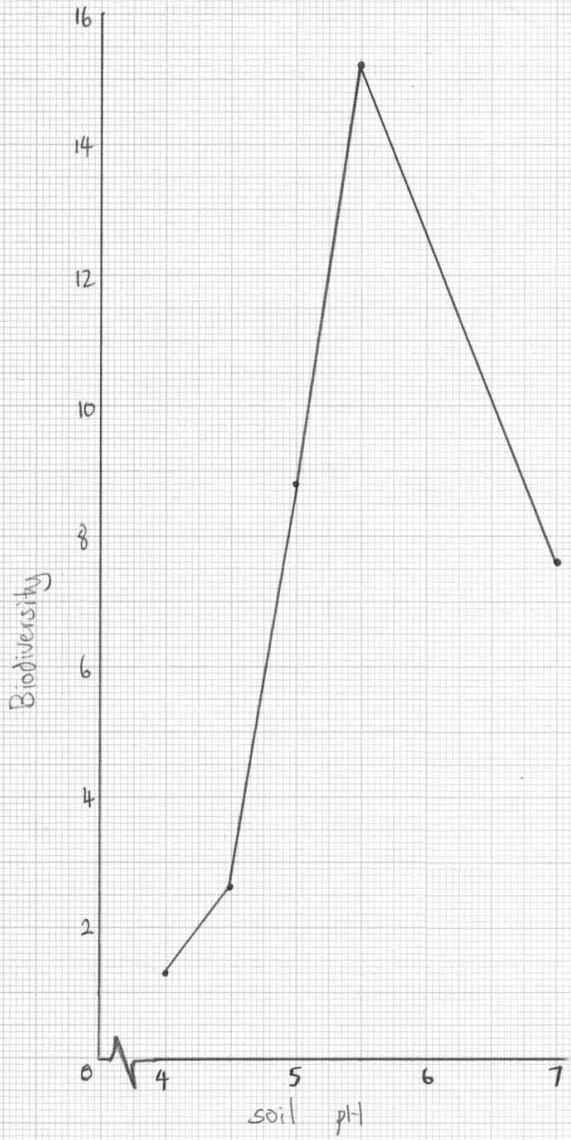
My results show that there is a higher ~~abundance~~ biodiversity of plants ~~species~~ in soils with a slightly acidic pH. The highest biodiversity is seen when there is a soil pH of 5.5; the biodiversi then decreases as the pH either rises or falls. This shows that a large variety of plant organisms have the ability to adapt & survive in soil pH of 5.5 conditions as it may be more ideal to their needs. My results also shows that various plants may still be able to survive in other soil pH conditions despite ~~their~~ biodiversity being relatively low; this means that some plants can still adapt to what can be considered as 'harsher' soil pH conditions.

Evaluation:

There were still various aspects which affected the accuracy of my results despite efforts to limit these; the majority of the errors were a result of failure in the ability to fulfill the control variables. Firstly, the locations had varying light intensity which may have affected both the soil pH & also the type or number (biodiversity) in the area due to the plants ability to adapt & survive in different levels of light intensity for photosynthes Furthermore, the were still slight variances in the slope where the biodiversity & soil pH readings were taken; this once again has an effect on the overall biodiversity of the area as it may discourage / encourage some plants to live there. In addition, there is also the problem of altitude / hight above sea level which would affect the biodiversity of an area in conjunction with its soil pH. Conversely, the distance from which my readings were taken from human interferences would also affect my results, altering its accuracy as it would/may vary the biodiversity & soil pH. Moreover, the overall conditions (eg: waterlogged soil) & climatic variances would also limit the accuracy of my results; this is because the climate & other abiotic factors (in conjunction) with the soil pH, plays a significant role in the biodiversi of an area, thus making & only taking into account the soil pH to judge the biodiversi a bold statement despite some of the realistic correlations it does present.

However, in order to improve this experiment, numerous factors could be taken into account, these may include:

A graph to show the biodiversity in areas of various levels of soil pH.




N.B. the biodiversity of soil pH level 5 is taken from an average of the two sites with soil pH level 5

∴ average biodiversity for site with soil pH 5 : $(10.9 + 6.6) \div 2 = 8.8$

Example 2

- Determine an area where there is a variance in soil pH but where other various abiotic factors such as aspect or altitude is kept as similar as possible & is controlled. This may require more time in choosing the areas but would allo results to be more reliable.
- Instead of using one representative sample of an area, take a number of samples & determine an average biodiversity of the area to make results more reliable & accurate.
- Attain more samples of soil pH & the biodiversity of the location to have a greater range of results to find further relations. Furthermore, attain / develop a more accurate scale for determining the soil pH. eg: 5.8 or 6.2 etc.